Linking fire ecology and fire risk: Understanding the first helps plan for the second

Brian P. Oswald
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Fire in the US

- North America is a fire continent
- Native Americans burned….all of the time
- Pre and Post Civil War settlement/logging boom set stage for dangerous conditions (lots of fuels, people all over, period of dry years…)
- Euro-Americans approach and use of fire influenced by use/non-use of fire in home region of Europe

Fire in the US

- Peshtigo October 1871
- Almost 1,618,742 ha in Wisconsin and Michigan
- 1500 people died (more than Great Chicago Fire)

Fire in the US

- Hinckley September 1894
- Central Minnesota
- At least 418 people died

And…

- 1910 (Big Burn/Great Idaho Fire) 1,214,056 ha, over 100 people
- Alaska 1957 (2,023,428 ha)
- Yellowstone 1988
- In last 20 years, we have often had record numbers of areas burned or fire events

US Fire Policy History

- Initial interest resulted in Yellowstone National Park
- 1876 Special Agent to look at US Forests
- 1881 Division of Forestry in US Department of Interior
- 1891 Forest Reserve Act-public lands can be placed as "forest reserves"
- 1905 Transfer Act-Moved Division to Department of Agriculture (commodity focus) and renamed US Forest Service
- 1911 Weeks Act – cooperation between Federal Government and States in rural wildland areas, mostly in eastern US
- 1916 National Park Service established in Department of Interior
- Decades of Fire Control/Suppression/Exclusion Efforts

US Fire Policy History

- 1924 Clark-McNary Act allowed USFS to purchase private lands to make National Forests, mostly in eastern US, built on Weeks Act
- 1964 Wilderness Act Really first policy stating that fire was a natural process
- 2000 "Fire Plan" Reduce impacts of wildfires on rural areas, ensure adequate resources in future, focus on fuels management

Fire Ecology

Major areas to consider are:

- Mechanisms to resist fire
- Response to fire
- Changes in environment
- Time
- Interactions with associated species
- Interactions with site/animals/management

It is all about the fuels

What are the successional pathways of ecosystems?

- If you keep fire out of grasslands, do shrubs come in?
- If a fire occurs in a shrub field, do they resprout, or covert to grasslands?
- If you cut or thin non-native tree species, will they resprout? What will happen to understory?
- If you don't cut, thin, or pile small diameter woody material on site, will the fuel loads increase fire danger?
- Will what you have done for last decades still work with climate change?

Ponderosa Pine

- Thick bark resists damage
- Self-prunes, high branches

- Fire thins out thick saplings
- Keep fire out, "dog-hair" thickets

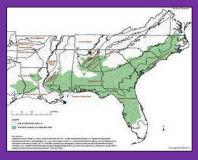
Ponderosa Pine

- Wide range in western US
- Millions of hectares

- Change in fire regime to stand-replacing
- Often need to thin before applying fire

Longleaf Pine

- Dominated Southeast US
- Cut-over, trouble regenerating until recently



- Unique grass-stage seedling
- Fire kept out other species, or kept them small

Longleaf Pine

•Converted to Loblolly pine plantations throughout region

•Restoration efforts very popular, many economic, safety and ecological benefits

Grassland invasion by shrubs

• Great Plains of US dominated by grasslands

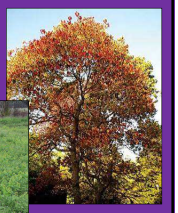
Conversion to farms, reduction in fires by Native Peoples, suppression activities changed landscape

Grassland invasion by shrubs

• Fire, sometimes with cutting or chemicals, only way to revert back to grass-dominated conditions

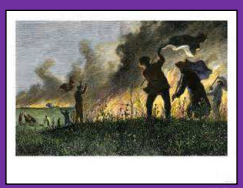
Invasive Species

• Introduced species often change the fire environment, almost always at a cost to native species



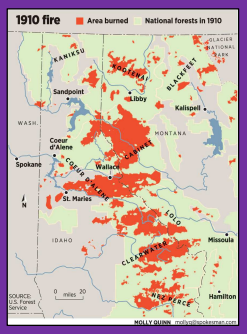
Prescribed Burning in the US

- Euro-Americans utilized fire as they settled the eastern part of the US
- Use was often similar to where they came from in Europe
  - Mediterranean Region: Herding and Pastures
  - Scandinavia: Slash and Burn Agriculture
  - Western Europe: Land Clearing, Stubble Removal
- They then blended these with Native American practices
- Scale of open land in US not a match for what they experienced in Europe, drier climate



Prescribed Burning in the US

- Fires in 1910 brought a anti-fire
- program to US



Prescribed Burning in the US

- US Forest Service began active anti-fire approach after 1910 fires, began using fire again in the 1960's.
- Restrictions were driven by politics, not ecology
- Areas where fire was still used : Southern US, Native American Reservations
- Over time, shift in attitude, greater linkage between the ecological role of fire to management goals began

Prescribed Burning in the US

- US Forest Service now performs prescribed burns across the US.
- Other Federal Agencies as well:
  - Bureau of Land Management
  - Fish and Wildlife Service
  - National Park Service
  - Bureau of Indian Affairs
  - Department of Defense
- State agencies also perform prescribed burns, as do non-government organizations like The Nature Conservancy

Prescribed Burning in the US

Many uses of Prescribed fire

- Wildlife Habitat
- Forestry
- Range Management
- Fuel Management
- Biodiversity
- Endangered Species

Prescribed Burning in the US

Challenges

- Smoke
- Wildland-Urban Interface
- Public Education (Smokey Bear and Firewise)
- Climate Change
- State differences
- Education in University Programs

So what?

- What are the lessons, if any, that we have learned in the US that might be applied here in the UK?
- Just as important, what can we learn from you?
- What should be the next steps?

Discussion and Break

Brian P. Oswald Arthur Temple College of Forestry and Agriculture, Stephen F. Austin State University

The Fire Issue in the Netherlands

- Annual increases in fire events
- Beginning to see impacts from climate change, with models projecting some of the most dramatic changes in Europe. All of NW Europe is seeing the same changes and same increases in fire events.
- Active population, but unclear on knowledge of the fire issue
- Many recent National Risk Assessments shows the increases in fire events transcends regional capabilities to manage such events

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Wildfire Fuels Assessment in the Netherlands

- What are the differences in wildfire awareness between Civilians, Foresters, Fire Fighters, Government Agency Staff and politicians?
- Is it "We don't have wildfire issues", "Leaving woody material on the ground is good for biodiversity", "We will fight any fire", "We don't see the smoke", or something else?

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"We don't see any smoke"

Schoorl Fire, 2010

Bastrop Fire, 2011

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"We don't see any smoke"

Strabrecht Fire July 2010

Bastrop Fire September 2011

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Hoge Veluwe National Park

- **530 ha**
- **Grass and Heath**
- **Put on scale as portion of entire country, if in lower 48 states of US, about the size of Kentucky**

Brian P. Oswald
Arthur Temple College of Forestry and Agriculture, Stephen F. Austin State

The Objectives of First Project

- Using sites in the Veluwe, develop a fuel photo series of 5 common vegetative communities following Ottmar and Vihnanek.
- Using the data obtained, match conditions where possible to US fuel models, or develop new models specific to Netherlands
- Estimate fire behavior based on these fuel models
- Provide methodology for future development across the entire country
- Plug data into fire spread models being developed

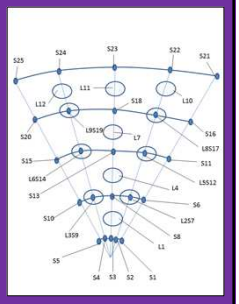
Earl Bryan, Forest Wildlife Biologist; Frank Wanrooij, Urban Forestry; Jessica Oswald, Sociology/Public Relations; Nienke Brouwer, Nature and Landscape Technique

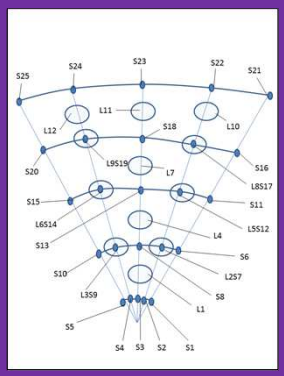
We sampled five different communities:

- Beech
- Heather
- Douglas-Fir
- Scots Pine
- Grassland

We used a modified method based on Ottmar and Vihnanek.

- 5 transects, each 46 Meters long
- Spaced 8 degrees off the previous line
- For a 32 degree spread



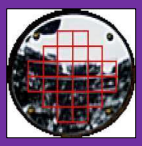


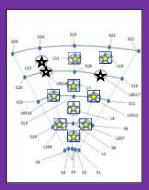
Once the plot was laid out, measurements are collected

- GPS coordinates
- Slope
- Aspect

The site was then photographed for a general view and overstory

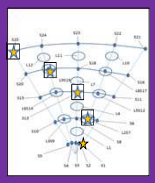
At each of the spots indicated by a ★, a densiometer reading was taken in the four cardinal directions to obtain a mean percent canopy cover.



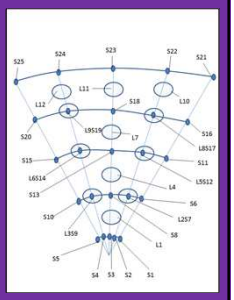


Litter and duff depths were recorded at 50 points within each site

We also took 5 duff samples, one at each ★, to be dried to determine bulk density.



Within the plot, we ran thirty-one, 15.4 meter transects, in random directions, from each of the sub-plot locations.

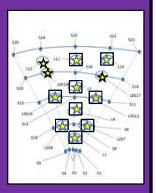


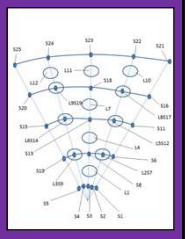
Using these transects we measured Down Woody Debris

Then using the same transects we accounted for what was present at every centimeter of the transects

At every ★ measured all shrubs and trees within a 3 meter radius circle.

- Total height
- Living or Dead
- Live height
- Dead height
- Diameter
- Basal diameter
- Canopy diameter

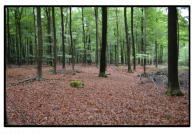


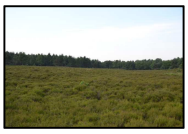


We sampled all shrubs and grasses by species, using a one meter square subplot, all vegetation within the square was clipped, identified, and placed into a bag and dried

Stereo Photo Series for Estimating Natural Fuels in The Netherlands

Volume I: Veluwe Region



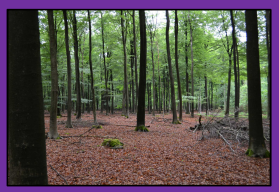


Brandweer veiligheidsregio Noord- en Oost-Gelderland

Results from First Project

Beech

- 4 different conditions (beech, upland beech, beech-mixed hardwood, closed canopy beech)
- Low rate of spread, low intensities unless long-term dry periods, then adjacent areas may be more hazardous



Results

Grassland

- 2 types
- High rates of spread with prevailing wind speeds, high intensities
- Bigger problem may be adjacent hazardous areas
- Based on recent fire in your National Park, more plots in this type may be needed

Results

Douglas-fir

- 2 types
- Thinned/open areas with shrubs or saplings easily can move into canopy of trees
- Dense stands less likely to burn very hot or fast, little chance to climb into canopy

Results

Scots Pine

- 3 types
- Moderate fuel loads with shrubs
- Moderate fuel loads with shrubs and grass
- High fuel loads with shrubs

Results

Heather

- 3 types
- Low fuel loads with grass
- Moderate fuel loads
- High fuel loads

Stereo Photo Series for Estimating Natural Fuels in The Netherlands

Volume 2: Dunes Region

Four types of grasslands were evaluated:

GR3: Low Load Coarse Grass. The primary carrier is grass less than 0.5 m tall with total loads less than other grass types. While flame heights may be relatively low (3.1 m), rates of spreads average 2.2 km/hr, and fire behavior is High to Very High.

GR5: Low Load Grass. The primary carrier is grass less than 0.5 m tall. While fire behavior class may be the same as GR3, rates of spread (5.5 km/hr) and flame heights (5.8 m) are greater.

GR6: Moderate Load Grass. The primary carrier of fire is continuous grass less than 1 m tall. This grazed site had higher rates of spread and flame heights than GR3 and GR5, with a resulting extreme fire behavior.

55

GR7: High Load Grass. The primary carrier of fire is continuous grass. Loads and depths are greater than other models, and grass is about 1 m tall. Under all conditions used, fire behavior was extreme, with flame heights over 7 m, and rate of spread above 6 km/hr.

56

Four types of open dune grasslands were evaluated:

ODG1: Sparse Load Open Dune Grass. Wind speed has little influence on fire behavior. Very dynamic type with fuel moisture driving fire behavior.

57

ODG2: Very Low Load Open Dune Grass. Heavier loads than ODG1 with wind still not greatly influencing fire behavior. Low flame heights due to low fuel heights but higher rates of spread than ODG1.

58

ODG 3: Low Load Open Dune Grass. Wind has increased impact on fire behavior. Increases in wind often shifts fire behavior from very high to extreme.

59

ODG4: High Load Open Dune Grass. Wind and live fuel moistures drive fire behavior.

60

Four types of dune shrub-grass communities were evaluated:

GS3 Moderate Load Grass-Shrub. The primary carrier of the fire is the combination of shrubs and grass. Mowed sites often fall within this fuel type. Low flame heights (4 m) and slower rates of spread (less than 3 km/hr) than adjacent heather sites. Fire behavior is usually very high.

Six types of new shrub communities were evaluated:

DS1 Coastal Dune Shrub: The primary carrier is common elder with sparse grass, resulting in over 2 km/hr rates of spread and over 1.0 m flame heights. The resulting fire behavior is moderate on these sites.

SH6: Moderate Load Shrub: The primary carrier of fire is the shrub component. The creeping willow dominated sites has very high fire behavior, but low rates of spread and flame heights compared to SH4.

SH8: High Load Shrub: Increased shrub fuels from SH6 resulted in over 2 km/h rates of spread and over 6 m flame heights, but the fire behavior was still very high.

SH9: Very High Load Shrub: More exposed to the wind than SH8, these sites had greater rates of spread (4.5 km/hr) and flame heights (13m), resulting in extreme fire behavior.

WG: Dune Valley Grey Willow Grove. Almost impossible to burn due to inherit moist conditions. Any fire behavior will be very low intensity, rate of spread, and flame heights

Current Sampling

- Peatlands in Northumberland: Bogs, Peat heather, Peat Forest, Peat Shrub
- 4 person crew under supervision of Ester Willemsen (IFV)
  - Nienke Brouwer (Sub-Manager IFV)
  - Michiel Gortzak (Hogeschool van Hall Larestein)
  - Courtney Threadgill (SFA)
  - Tamara Bennett (SFA)

Possible Next Steps

- Is such a system potentially useful for the UK?
- Is such information needed for your fire spread models?
- If answer is yes, who, how and when?

Possible Next Steps

- Survey agency and public on wildfire opinions/first step in developing a Dutch specific "Firewise" Program
- Create a Northwest Europe (NWEU) Section of the Association for Fire Ecology
- 6th International Fire Ecology and Management Congress, November 16-20, 2015 in San Antonio, Texas, USA
- Have a NWEU fire conference in 2016 or 2017

Thank you